TCE in the Workplace

What is TCE?

Trichloroethylene, or TCE, is a human-made chemical with properties that make it useful in a number of industrial processes and consumer products. TCE is often used as a metal degreaser and in the production of refrigerant and other chemicals. It is found in a number of consumer products, including adhesives, lubricants, paints, varnishes, paint strippers, pesticides, and condenser coil cleaner. TCE is a popular chemical in the textile processing and dry cleaning industries for cleaning cotton, wool, and other fabrics.

How are workers exposed to TCE?

TCE is a volatile chemical, which means that it can easily turn from liquid to vapor, which can be breathed in. The skin, eyes, and mouth can also absorb TCE after direct contact. TCE can present health risks to workers who handle the liquid or who breathe in TCE vapor without wearing proper safety gear.

How can TCE affect a worker's health?

Skin contact with high concentrations of TCE may cause skin irritation, such as a rash. Breathing in medium to high concentrations of TCE may cause headaches, dizziness, and sleepiness, while extremely high concentrations may cause coma and even death. Repeated exposures to TCE over long periods of time may cause cancer.[1]

While exposure to TCE can affect everyone, newer evidence shows that TCE exposure during pregnancy can have serious effects on the developing fetus, including an increased risk of heart defects. This can happen at low levels of TCE and very early in pregnancy, before someone may know that they are pregnant. Therefore, workplaces should take action to prevent harmful TCE exposures at all times, and especially for workers who are or may become pregnant.

TCE is a chlorinated solvent.

The chemical structure of TCE has chlorine atoms that help to dissolve organic materials like fats and greases. This makes it a useful chemical for removing grease from metal and stains from cloth, but also potentially harmful to human and environmental health.

Pregnant individuals should avoid exposure to TCE.

TCE can be especially harmful for the developing fetus—even when indoor air levels of TCE are low. At low levels, TCE has no odor to warn that contaminants are in the air.

What workplace guidelines are available for TCE?

The following workplace guidelines are available for TCE in air:

Year Issued	Issuing Institution or Agency	Guideline Type	Guideline
1978	National Institute for Occupational Safety and Health (NIOSH)[2]	Recommended exposure limit	25 ppm*
1989	Occupational Safety and Health Association (OSHA)[3]	Permissible exposure limit	100 ppm
2006	American Conference of Governmental Industrial Hygienists[3] (ACGIH)	8-hour time-weighted average	10 ppm
		Short-term exposure limit	25 ppm
2017	Wisconsin Department of Natural Resources (DNR)[4]‡	Vapor action level	1.6 ppbV†

*ppm = parts per million; †1.6 parts per billion by volume (ppbV) = 8.8 micrograms per cubic meter ($\mu g/m^3$)
‡ Wisconsin DHS recognizes recent research which demonstrates that much lower levels of TCE can be harmful to workers. Unlike older national guidelines, Wisconsin DNR's vapor action level for TCE takes newer evidence of fetal toxicity into consideration.

What are ways to keep workers safe?

Employers should minimize worker exposures to TCE and implement best management practices to reduce TCE in the workplace.

- Use alternative solvents that do not have the reproductive and carcinogenic risks of TCE.
- Store TCE in well-sealed containers in a designated chemical storage location that is away from air intakes for heating, ventilation, and cooling (HVAC) systems.
- Maintain HVAC systems and ensure adequate ventilation in critical areas where TCE is highly used, such as in pouring, mixing, or application settings.
- Develop and keep handy safety protocols to address TCE spills.
- Train workers who handle TCE directly in proper personal protective equipment (PPE) use and handling techniques.
- Monitor indoor air levels of TCE and strive to maintain them below Wisconsin's Vapor Action Levels[4] for small commercial and industrial workplace settings for the best worker protection.
- Educate workers, and especially those of childbearing age, on TCE health risks.
- Assign pregnant individuals to areas or job categories that do not involve direct handling of TCE. If an alternative job assignment is not possible, medically-cleared pregnant workers should wear respirators containing an organic vapor cartridge when directly handling TCE.

Contact us for help.

The Wisconsin Safety and Health Consultation Program provides free services to measure worker exposures and explore solvent alternatives. Call 800-947-0553 or visit http://slh.wisc.edu/wiscon for more information. DHS staff are also available to consult on this topic: Send an email to DHSEnvHealth@dhs.wi.gov.

References

1. ATSDR. Trichloroethylene - ToxFAQs. https://wwwn.cdc.gov/TSP/ToxFAQs/ToxFAQsDetails.aspx?faqid=172&toxid=30.
2. NIOSH. Pocket Guide to Chemical Hazards, Appendix C—Supplementary Exposure Limits. https://www.cdc.gov/niosh/npg/nengapdxc.html.
3. OSHA. OSHA Occupational Chemical Database—TRICHLOROETHYLENE. https://www.osha.gov/chemicaldata/684.
4. WI DNR. Guidance: Wisconsin Vapor Quick Look-Up Table, Indoor Air Vapor Action Levels and Vapor Risk Screening Levels.